Health Psychology
2018, Vol. 37, No. 3, 301–305

0278-6133/18/$12.00 http://dx.doi.org/10.1037/hea0000564

BRIEF REPORT

Trait Emotion Regulation Strategies and Diurnal Cortisol Profiles in Healthy Adults

Lisa R. Otto
New York State Psychiatric Institute, New York, New York and Columbia University

Nancy L. Sin and David M. Almeida
Pennsylvania State University

Richard P. Sloan
New York State Psychiatric Institute, New York, New York

Objective: Experimental studies have shown that 2 emotion regulation strategies—suppression and reappraisal—are associated with differential profiles of physiological activation in response to a stress test. The present study aims to add to those findings by investigating whether individual differences in trait emotion regulation strategies are associated with diurnal cortisol patterns in a naturalistic context. ***Method:*** A sample of 46 men and women from the Midlife in the United States II (MIDUS II) study completed the Emotion Regulation Questionnaire (ERQ) and provided 4 salivary cortisol samples per day over 4 consecutive days. Trait reappraisal and suppression were tested as predictors of 3 cortisol parameters averaged across days: cortisol awakening response (CAR), diurnal cortisol slope (DCS), and area under the curve with respect to ground (AUCg). ***Results:*** Higher scores on the suppression scale were associated with more physiological activation, as indicated by steeper CAR and flatter DCS. Suppression was not associated with AUCg, and reappraisal was not predictive of any cortisol parameter. ***Conclusions:*** Individual differences in suppression, but not reappraisal, were linked to greater cortisol activation in this naturalistic study. These preliminary results add to a growing body of findings that link suppression to adverse psychological and physiological profiles.

Keywords: diurnal cortisol, emotion regulation, suppression, reappraisal, MIDUS II

Supplemental materials: http://dx.doi.org/10.1037/hea0000564.supp

Emotions are whole-body phenomena that give rise to response tendencies that involve changes in subjective experience, behavior, and physiology (Lazarus, 1991). Consequently, the strategies that individuals use to regulate their emotions can have implications for physical and mental health. Emotion regulation strategies can be classified into antecedent-focused strategies, such as reappraisal, where regulatory behaviors occur prior to emotion response tendencies, and response-focused strategies, such as suppression, which influence the experiential, behavioral, and physiological aspects of the emotional response (Gross & John, 2003). According to the process model of emotion regulation (Gross, 1998), reappraisal acts early in the emotion-generative process and entails reevaluating a possibly emotion-eliciting situation, thereby changing its meaning and altering its emotional impact. Suppression acts later in the emotion-generative process, after an event has been deemed emotionally relevant and involves inhibiting or reducing outward expression of emotional arousal (Gross, 1998). Modulating emotional responses (suppression) rather than one's appraisal

This article was published Online First November 27, 2017.

Lisa R. Otto, Department of Psychiatry, Columbia University Medical Center, Division of Behavioral Medicine, New York State Psychiatric Institute, New York, New York and Department of Biobehavioral Sciences, Teachers College, Columbia University; Nancy L. Sin, Center for Healthy Aging, Department of Biobehavioral Health, Pennsylvania State University; David M. Almeida, Center for Healthy Aging, Department of Human Development and Family Studies, Pennsylvania State University; Richard P. Sloan, Department of Psychiatry, Columbia University Medical Center, Division of Behavioral Medicine, New York State Psychiatric Institute.

Lisa R. Otto is now at the Clinical Neurobiology Lab, Department of Psychiatry, Charité Berlin, Germany. Nancy L. Sin is now at Department of Psychology, University of British Columbia.

The research reported in this article was supported by the MacArthur Foundation Research Network on Successful Midlife Development, the United States Department of Health and Human Services, National Institutes of Health and National Institute on Aging, NIH National Center for Advancing Translational Sciences, Clinical and Translational Science Award. The funding sources had no further role in the study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

Correspondence concerning this article should be addressed to Richard P. Sloan, Department of Psychiatry, Division of Behavioral Medicine, 622 West 168th Street, PH 1540H, New York, NY 10032. E-mail: rps7@cumc.columbia.edu

of an emotional situation (reappraisal) is thought to be more effortful, and the regulation is achieved at a higher cost. Accordingly, suppression and reappraisal are associated with differential psychological and physiological profiles. In particular, previous research has linked reappraisal to greater experience and expression of positive emotion and decreased experience and expression of negative emotion, as well as fewer symptoms of depression. Suppression, on the contrary, has been linked to decreased expression and experience of positive emotion and greater experience of negative emotion, a feeling of incongruence and elevated depressive symptoms (Gross & John, 2003). Physiologically, reappraisal has been linked to more adaptive patterns of physiological responding (e.g., Egloff, Schmukle, Burns, & Schwerdtfeger, 2006; Mauss, Cook, Cheng, & Gross, 2007) as well as to beneficial health outcomes such as decreased levels of inflammation and decreased cardiovascular disease risk (Appleton, Loucks, Buka, & Kubzansky, 2014). Suppression has been associated with heightened sympathetic nervous system activation, higher levels of inflammation and increased cardiovascular disease risk (Appleton, Buka, Loucks, Gilman, & Kubzansky, 2013; Appleton et al., 2014; Gross, 1998; Gross & Levenson, 1997).

Among the physiological domains found to be affected by the regulation of emotion is the neuroendocrine secretion of cortisol. Diurnal cortisol rhythms of healthy individuals are characterized by a pronounced increase 30–45 min after waking (cortisol awakening response, CAR) and a steady decline over the remainder of the day (diurnal cortisol slope, DCS), reaching the nadir approximately 16 hr after waking (Miller et al., 2016). Cortisol exerts wide-ranging effects on the immune, metabolic and central nervous systems (Sapolsky, Romero, & Munck, 2000) and can thus be considered a biomarker of psychological and physiological health. In fact, adverse physical and mental health outcomes have been linked to altered cortisol patterns of flattened diurnal slopes and both enhanced and reduced CARs. General life stress, obesity, and depression have been linked to increased CAR, while posttraumatic stress disorder, fatigue syndrome, cardiovascular disorders, depression and, interestingly, positive psychological traits have been related to reduced CAR (for reviews, see Chida & Steptoe, 2009; Fries, Dettenborn, & Kirschbaum, 2008).

Previous research on emotion regulation and cortisol has mainly focused on neuroendocrine reactivity to a stressor in a laboratory setting. For example, trait suppression and reappraisal, as well as experimental induction of reappraisal, have been linked to higher cortisol reactivity in response to a psychosocial stressor (Denson, Creswell, Terides, & Blundell, 2014; Lam, Dickerson, Zoccola, & Zaldivar, 2009). In contrast, longer-term cognitive-behavioral training (CBT)—of which reappraisal is a primary, however, not isolated aspect—has been shown to decrease cortisol reactivity to a psychosocial stress test, relative to controls without CBT (Gaab et al., 2003). To our knowledge, associations of trait emotion regulation strategies and diurnal cortisol patterns in healthy adults have not been studied in a naturalistic setting before. It is important to examine these associations outside the laboratory in daily life, as diurnal patterns in salivary cortisol are predictive of health outcomes and mortality (e.g., Kumari, Shipley, Stafford, & Kivimaki, 2011).

The present study investigates whether individual differences in suppression and reappraisal are linked to diurnal cortisol patterns in a naturalistic context. Based on the process model of emotion regulation (Gross, 1998) and previous research, we hypothesize that the higher cost of regulating emotions with suppression will be reflected in more activated patterns of diurnal cortisol, as indicated by steeper CAR, flatter DCS, and higher total cortisol output (AUCg). Additionally, we expect that reappraisal will be associated with healthier patterns of steeper DCS and lower AUCg, whereas the CAR could be either enhanced (suggesting an adaptive boost to face the demands of the day; Adam, Hawkley, Kudielka, & Cacioppo, 2006) or reduced (indicating less physiological activation; Chida & Steptoe, 2009).

Method

Participants

This study uses cross-sectional data from the MIDUS II study, which was designed to examine how behavioral, psychological, and social factors accounted for variations in health and well-being in a national sample of noninstitutionalized, English-speaking adults. MIDUS II contains projects that include a daily diary substudy called the National Study of Daily Experiences (NSDE) and a neuroscience substudy. Assessments of salivary cortisol were obtained from the NSDE, and a questionnaire on emotion regulation was administered in the neuroscience substudy. The ERQ was added to the study protocol late; of the 331 participants in the neuroscience substudy, 118 were administered the ERQ. Of these 118, 46 participants also completed the saliva collection protocol in the NSDE. The final sample was 50% female and 63% Caucasian with a mean age of 54.04 years (SD = 10.24). Procedures were approved by Institutional Review Boards at the University of Wisconsin, the Pennsylvania State University, the University of California—Los Angeles, and Georgetown University and all participants provided informed consent.

Procedures and Measures

Emotion regulation. Participants completed the ERQ (Gross & John, 2003), which assessed the typical use of suppression and reappraisal. The Suppression scale consisted of four items (e.g., "I control my emotions by not expressing them"), and the Reappraisal scale consisted of six items (e.g., "I control my emotions by changing the way I think about the situation I'm in"). Ratings were made on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*) and averaged within each subscale. The subscales had good internal consistency reliability (Cronbach's alpha = .80 for suppression and 0.74 for reappraisal).

Salivary cortisol. The saliva collection protocol for the NSDE has been described in detail elsewhere (Almeida, McGonagle, & King, 2009). Briefly, participants were instructed to collect four saliva samples per day (immediately upon waking, 30 min after waking, before lunch, and before bed) for four consecutive days using salivette collection devices (Sarstedt, Nümbrecht, Germany). As several substances can compromise salivary immunoassays by altering *p*H levels and impairing antibody binding reactions, participants were instructed to collect the samples before eating, drinking, brushing their teeth, or consuming any caffeinated products. The *p*H levels were checked and corrected (*p*H 4–9) prior to immunoassay for cortisol (Almeida, McGonagle, & King, 2009). Participants recorded the time of each saliva sample on a paper log,

in addition to reporting the sampling times during nightly telephone interviews. Salivettes were processed and assayed at the MIDUS Biological Core at the University of Wisconsin, Madison.

Based on previous research on emotions and diurnal cortisol (e.g., Adam et al., 2006), we calculated three diurnal cortisol indices. CAR was calculated as 30-min postwaking cortisol level minus waking cortisol level, divided by time (in hours) between the two samples. DCS was calculated as bedtime cortisol minus waking cortisol, divided by hours between the two samples. AUCg was computed using the trapezoid formula from Pruessner, Kirschbaum, Meinlschmid, and Hellhammer (2003). The diurnal cortisol indices were calculated for each day, then averaged across days for each participant. Days were excluded from the calculation of the cortisol indices if (a) saliva collection time stamps were missing, (b) the participant woke up after 12 p.m., (c) the participant was awake <12 hr or >20 hr, or (d) if there was an indication of noncompliance with the saliva collection protocol such that <15 or >60 min elapsed between the first two measurements (Stawski, Cichy, Piazza, & Almeida, 2013). The analytic sample sizes were 46 participants for DCS and 43 participants for CAR and AUCg.

Covariates. We chose to control for the following variables based on previous related research on cortisol (e.g., Adam & Kumari, 2009; Stawski et al., 2013) and on emotion regulation (Gross & John, 2003): age, gender, body mass index (BMI), smoking status, use of cortisol-altering medications, and self-rated health. As part of the parent MIDUS II study, participants rated their physical health on a 5-point scale (*excellent, very good, good, fair,* or *poor*). As scores increase, self-rated health decreases. Height and weight were measured at a clinic visit and used to calculate BMI. During daily diary telephone interviews across eight evenings in the NSDE, participants reported daily cigarette smoking. A dummy-coded variable was created to indicate any smoking (1) versus no smoking (0). Another dummy-coded variable indicated the use of any cortisol-altering medication during the saliva collection period (including cortisone, steroids, antidepressants, hormonal, and antianxiety medications). Data on daily smoking and medication use during saliva collection were missing for seven and five participants, respectively. For these participants, smoking status and use of corticosteroid and/or sex hormone medications were obtained from the biomarker substudy in MIDUS II. Daily stressors were reported in the daily diary study (Almeida, Wethington, & Kessler, 2002) but were not correlated with any of the cortisol parameters in the present study. To keep the models parsimonious, we did not include daily stressors in further analyses.

Statistical analyses. Descriptive analyses and correlations were run to examine participant characteristics, emotion regulation, and cortisol variables. For the primary analyses, suppression and reappraisal were examined separately in linear regression models as predictors of CAR, DCS, and AUCg. Models were adjusted for age, gender, BMI, smoking (yes/no), medications (yes/no), and self-rated health (0–4 scale). Analyses were conducted using SAS 9.4.

Results

Descriptive Analyses and Correlations

Participants were 46 adults (50% female; 63% white) with a mean age of 54.04 years (SD = 10.24). Further descriptives are presented in the online supplementary materials. Cortisol values exhibited a diurnal pattern, in which the mean (SD) cortisol level at waking was 13.91 (6.13) nmol/L, increased to 19.90 (6.95) nmol/L 30-min after waking, declined to 6.63 (3.03) nmol/L before lunch, and further declined to 3.65 (2.83) nmol/L at bedtime.

Correlations between participant characteristics and emotion regulation showed that males had higher trait suppression (r = .49, p < .001), and with increasing age there was a marginal increase in trait reappraisal (r = .28, p = .06). Partialing for age, smoking, and higher BMI were correlated with flatter DCS (r = .31 and r = .38, respectively, p's < 0.05). In addition, as suppression increased, the slope of CAR increased (r = .32, p = .04) while the DCS got marginally flatter (r = .27, p = .08), partialing for age and gender. Suppression was not correlated with AUCg, and reappraisal was not correlated with CAR, DCS, or AUCg.

Emotion Regulation Strategies as Predictors of Cortisol

In linear regression models, trait reappraisal was not associated with any of the three cortisol parameters (Table 1). Suppression was positively correlated with the steepness of the slope of CAR, controlling for age and gender. This association remained after further adjustment for trait reappraisal, BMI, medications, smoking, and self-rated health. Suppression was also associated with flatter DCS but was not predictive of AUCg.

Discussion

The present study adds to previous research on trait emotion regulation and cortisol by examining diurnal salivary cortisol in healthy adults in daily life. Results indicate that individual differences in suppression are linked to diurnal cortisol parameters. Specifically, as trait suppression increased, the steepness of the CAR curve increased, the DCS got flatter, and the AUCg remained unchanged. Trait reappraisal showed no associations with any of the three cortisol parameters.

The findings from this naturalistic study are consistent with previous laboratory research showing a link between trait suppression and physiological activation. On a broader level, these results are in line with the long-held notion that inhibition of emotional expression has negative effects on physical and mental health, especially when inhibition occurs chronically (for review, see Consedine, Magai, & Bonanno, 2002). Suppression is cognitively and physically effortful (e.g., Richards & Gross, 1999), which may place cumulative stress on the body and increase vulnerability to illness (e.g., Appleton et al., 2014).

The null results for reappraisal were unsurprising given the mixed findings in the literature on reappraisal and physiological activity (Denson et al., 2014; Egloff et al., 2006; Gaab et al., 2003; Lam et al., 2009). The equivocal literature suggests that there could be differences in cortisol patterns between experimentally manipulated reappraisal—which might increase cortisol reactivity in the short-term—compared with trait reappraisal, which has been proposed to buffer against cortisol reactivity over the long term as it is more automatic and less effortful (Denson et al., 2014; Gaab et al., 2003). Similarly, the timeframe of effects (such as immediate reactivity to a stressor vs. longer-term diurnal cortisol patterns) and contexts of emotion-eliciting situations (such as laboratory vs. naturalistic contexts) might be critical elements to consider when examining physiological correlates of emotion regulation strate-

Table 1
Emotion Suppression and Reappraisal as Predictors of Diurnal Cortisol Parameters

Variable	Cortisol awakening response (n = 43); unstandardized B (SE)			Diurnal cortisol slope (n = 46); unstandardized B (SE)			AUCg (n = 43); unstandardized B (SE)		
	Model 1[a]	Model 2[b]	Model 3[c]	Model 1[a]	Model 2[b]	Model 3[c]	Model 1[a]	Model 2[b]	Model 3[c]
Intercept	9.36 (1.66)***	9.53 (1.73)***	14.35 (2.19)***	−.67 (.06)***	−.68 (.06)***	−.62 (.08)***	131.32 (6.81)***	131.86 (6.94)***	136.21 (10.42)***
Suppression	3.16 (1.52)*		3.01 (1.38)*	.09 (.05)†		.11 (.05)*	8.05 (6.25)		9.57 (6.54)
Reappraisal		1.92 (2.10)	2.23 (1.83)		−.05 (.07)	−.05 (.06)		.26 (8.44)	−2.04 (8.69)
Age	−.16 (.18)	−.09 (.18)	−.23 (.16)	.01 (.01)	.01 (.01)	.01 (.01)	.22 (.72)	.47 (.72)	−.05 (.77)
Gender[d]	−5.39 (2.00)**	−2.86 (1.80)	−6.46 (2.02)**	−.14 (.07)†	−.08 (.06)	−.18 (.07)*	.32 (8.19)	5.97 (7.24)	1.71 (9.61)
BMI			.70 (.25)**			.02 (.01)**			.44 (1.20)
Medication use			−11.25 (4.09)**			−.25 (.15)†			6.92 (19.42)
Current smoker			−7.30 (3.85)†			.07 (.14)			−28.91 (18.31)
Self-rated health			−3.91 (1.93)†			.02 (.07)			−.09 (9.17)

Note. AUCg = area under the curve with respect to ground.
[a] Model 1 tests suppression as a predictor of cortisol, adjusting for age and gender. [b] Model 2 tests reappraisal as a predictor of cortisol, adjusting for age and gender. [c] Model 3 includes additional covariates for body mass index (BMI), use of any cortisol-altering medications (1 = yes, 0 = no), smoking status (1 = yes, 0 = no), and self-rated physical health (0–3 scale). [d] Gender was effect coded (−1 = female, 1 = male), such that associations between emotion regulation and cortisol can be interpreted as the effects averaged across females and males.
† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

gies (Aldao, 2013). As each of those elements might be associated with different cortisol output, they may need to be considered separately to obtain consistent results. Lastly, the null findings between reappraisal and diurnal cortisol could be due to reporting bias, such that participants' perceptions of how they typically regulate their emotions may differ from their actual emotion regulation in daily life.

Limitations and Future Directions

Our findings came from a small sample and therefore should be interpreted as preliminary. Caution should be taken in generalizing the results to other populations. As this was a cross-sectional study, inferences about causality cannot be made. Emotion regulation was assessed using a questionnaire administered at a single time point; we did not collect data on people's actual use of emotion regulation strategies in real-life situations during the same days as the saliva collection. Future research could collect repeated assessments of state emotion regulation, emotion-eliciting situations, and diurnal cortisol in daily life to examine whether the use of suppression versus reappraisal strategies are linked to concurrent or subsequent changes in cortisol. Furthermore, future research is needed to examine diurnal cortisol rhythms as potential pathways linking trait emotion regulation to downstream health outcomes.

References

Adam, E. K., Hawkley, L. C., Kudielka, B. M., & Cacioppo, J. T. (2006). Day-to-day dynamics of experience—Cortisol associations in a population-based sample of older adults. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 103,* 17058–17063. http://dx.doi.org/10.1073/pnas.0605053103

Adam, E. K., & Kumari, M. (2009). Assessing salivary cortisol in large-scale, epidemiological research. *Psychoneuroendocrinology, 34,* 1423–1436. http://dx.doi.org/10.1016/j.psyneuen.2009.06.011

Aldao, A. (2013). The future of emotion regulation research: Capturing context. *Perspectives on Psychological Science, 8,* 155–172. http://dx.doi.org/10.1177/1745691612459518

Almeida, D. M., McGonagle, K., & King, H. (2009). Assessing daily stress processes in social surveys by combining stressor exposure and salivary cortisol. *Biodemography and Social Biology, 55,* 219–237. http://dx.doi.org/10.1080/19485560903382338

Almeida, D. M., Wethington, E., & Kessler, R. C. (2002). The Daily Inventory of Stressful Events. *Assessment, 9,* 41–55.

Appleton, A. A., Buka, S. L., Loucks, E. B., Gilman, S. E., & Kubzansky, L. D. (2013). Divergent associations of adaptive and maladaptive emotion regulation strategies with inflammation. *Health Psychology, 32,* 748–756. http://dx.doi.org/10.1037/a0030068

Appleton, A. A., Loucks, E. B., Buka, S. L., & Kubzansky, L. D. (2014). Divergent associations of antecedent- and response-focused emotion regulation strategies with midlife cardiovascular disease risk. *Annals of Behavioral Medicine, 48,* 246–255. http://dx.doi.org/10.1007/s12160-014-9600-4

Chida, Y., & Steptoe, A. (2009). Cortisol awakening response and psychosocial factors: A systematic review and meta-analysis. *Biological Psychology, 80,* 265–278. http://dx.doi.org/10.1016/j.biopsycho.2008.10.004

Consedine, N. S., Magai, C., & Bonanno, G. A. (2002). Moderators of the emotion inhibition-health relationship: A review and research agenda. *Review of General Psychology, 6,* 204–228. http://dx.doi.org/10.1037/1089-2680.6.2.204

Denson, T. F., Creswell, J. D., Terides, M. D., & Blundell, K. (2014). Cognitive reappraisal increases neuroendocrine reactivity to acute social stress and physical pain. *Psychoneuroendocrinology, 49,* 69–78. http://dx.doi.org/10.1016/j.psyneuen.2014.07.003

Egloff, B., Schmukle, S. C., Burns, L. R., & Schwerdtfeger, A. (2006). Spontaneous emotion regulation during evaluated speaking tasks: Associations with negative affect, anxiety expression, memory, and physiological responding. *Emotion, 6,* 356–366. http://dx.doi.org/10.1037/1528-3542.6.3.356

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): Facts and future directions. *International Journal of Psychophysiology, 72,* 67–73. http://dx.doi.org/10.1016/j.ijpsycho.2008.03.014

Gaab, J., Blättler, N., Menzi, T., Pabst, B., Stoyer, S., & Ehlert, U. (2003). Randomized controlled evaluation of the effects of cognitive-behavioral stress management on cortisol responses to acute stress in healthy subjects. *Psychoneuroendocrinology, 28,* 767–779. http://dx.doi.org/10.1016/S0306-4530(02)00069-0

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: the acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology, 106,* 95–103. http://dx.doi.org/10.1037/0021-843X.106.1.95

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74,* 224–237. http://dx.doi.org/10.1037/0022-3514.74.1.224

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85,* 348–362. http://dx.doi.org/10.1037/0022-3514.85.2.348

Kumari, M., Shipley, M., Stafford, M., & Kivimaki, M. (2011). Association of diurnal patterns in salivary cortisol with all-cause and cardiovascular mortality: Findings from the Whitehall II study. *The Journal of Clinical Endocrinology and Metabolism, 96,* 1478–1485. http://dx.doi.org/10.1210/jc.2010-2137

Lam, S., Dickerson, S. S., Zoccola, P. M., & Zaldivar, F. (2009). Emotion regulation and cortisol reactivity to a social-evaluative speech task. *Psychoneuroendocrinology, 34,* 1355–1362. http://dx.doi.org/10.1016/j.psyneuen.2009.04.006

Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press. Retrieved from http://www.ebrary.com

Mauss, I. B., Cook, C. L., Cheng, J. Y. J., & Gross, J. J. (2007). Individual differences in cognitive reappraisal: Experiential and physiological responses to an anger provocation. *International Journal of Psychophysiology, 66,* 116–124. http://dx.doi.org/10.1016/j.ijpsycho.2007.03.017

Miller, R., Stalder, T., Jarczok, M., Almeida, D. M., Badrick, E., Bartels, M., . . . Kirschbaum, C. (2016). The CIRCORT database: Reference ranges and seasonal changes in diurnal salivary cortisol derived from a meta-dataset comprised of 15 field studies. *Psychoneuroendocrinology, 73,* 16–23. http://dx.doi.org/10.1016/j.psyneuen.2016.07.201

Pruessner, J. C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D. H. (2003). Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology, 28,* 916–931. http://dx.doi.org/10.1016/S0306-4530(02)00108-7

Richards, J. M., & Gross, J. J. (1999). Composure at any cost? The cognitive consequences of emotion suppression. *Personality and Social Psychology Bulletin, 25,* 1033–1044. http://dx.doi.org/10.1177/01461672992511010

Sapolsky, R. M., Romero, L. M., & Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine Reviews, 21,* 55–89.

Stawski, R. S., Cichy, K. E., Piazza, J. R., & Almeida, D. M. (2013). Associations among daily stressors and salivary cortisol: Findings from the National Study of Daily Experiences. *Psychoneuroendocrinology, 38,* 2654–2665. http://dx.doi.org/10.1016/j.psyneuen.2013.06.023

Received February 7, 2017
Revision received June 12, 2017
Accepted August 11, 2017 ■